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RAN

RAN Sharing Parameter Description

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1 Change History

The change history provides information on the changes in different document versions.

Document and Product Versions

Table 1-1 Document and product versions

Document Version	RAN Version
01 (2009-03-30)	11.0
Draft (2009-03-10)	11.0
Draft (2009-01-15)	11.0

This document is based on the BSC6810 and 3900 series NodeBs.

The available time of each feature is subject to the RAN product roadmap.

There are two types of changes, which are defined as follows:

- Feature change: refers to the change in the RAN sharing.
- Editorial change: refers to the change in the information that was inappropriately described or the addition of the information that was not described in the earlier version.

01 (2009-03-30)

This is the document for the first commercial release of RAN11.0.

Compared with draft (2009-01-15), this issue optimizes the description.

Draft (2009-03-10)

This is the second draft of the document for RAN11.0.

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Compared with draft (2009-01-15), draft (2009-03-10) optimizes the description.

Draft (2009-01-15)

This is the initial draft of the document for RAN11.0.

Compared with issue 02 (2008-07-30) of RAN10.0, draft (2009-01-15) incorporates the following changes:

Change Type	Change Description	Parameter Change
Feature change	None.	None.
Editorial change	The title of the document is changed from *RAN Sharing Description* to *RAN Sharing Parameter Description*.	None.

□□□□

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2 RAN Sharing Introduction

Introduction

Radio Access Network (RAN) Sharing enables multiple operators to share a set of RAN equipment that covers the same area.

Operators adopt the dedicated frequency solution instead of the common frequency solution. In this dedicated frequency solution, all the RAN equipment, such as Radio Network Controller (RNC) and NodeB, are physically shared. By soft-splitting a physical RAN into different logical RANs, multiple operators can cover the same area with their own frequency in only one physical RAN.

When a User Equipment (UE) accesses a cell, the RNC identifies the operator according to the cell and then routes the UE to the operator's Core Network (CN) node. If the operator employs Iu Flex, the RNC routes the UE to one of the operator's CN nodes according to the UE's Network Resource Identifier (NRI), which is derived from the UE's Temporary Mobile Subscriber Identity (TMSI) or Packet Temporary Mobile Subscriber Identity (P-TMSI).

Figure 2-1 shows the structure of RAN Sharing. The structure is mainly composed of a shared RAN and an Operation and Maintenance (OM) system. RAN Sharing brings the changes of functions, interfaces, license management, and configurations, which are described in detail hereinafter.

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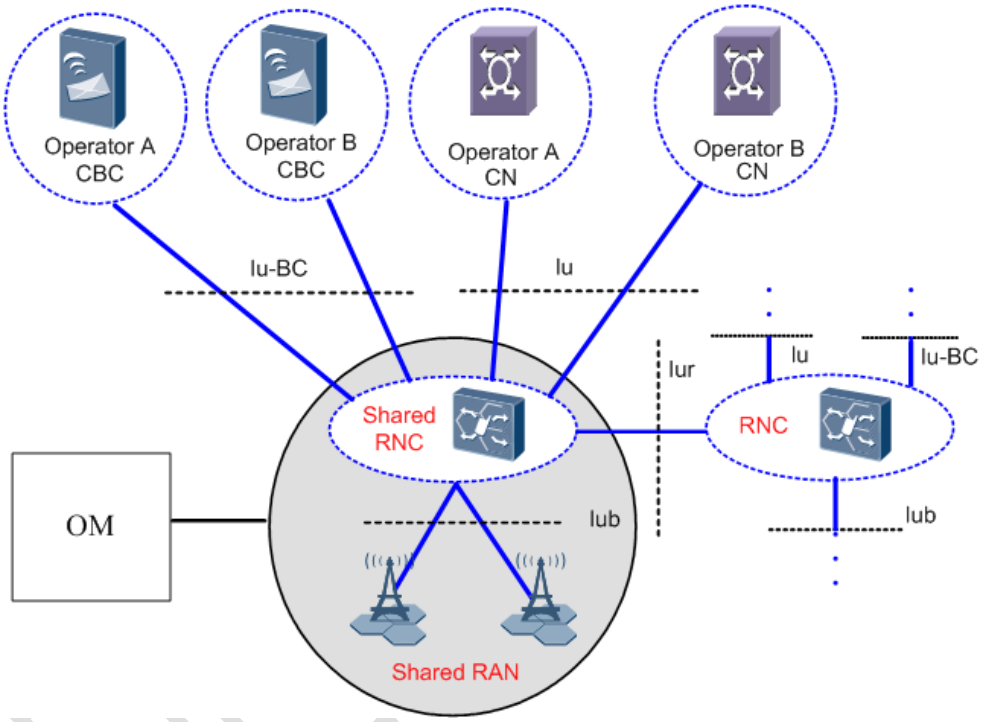
Figure 2-1 RAN Sharing



RAN Sharing enables mobile operators to economize network deployment and raise network resource usage. This feature brings benefits for all parties involved in the Universal Mobile Telecommunications System (UMTS).

- Cost saving

  The driving force for operators to share networks is the substantial saving of CAPEX (capital expenditure) and OPEX (operating expenditure) . RAN Sharing can save approximately 30% to 40% CAPEX and OPEX.
- Fast deployment

  RAN Sharing enables a fast deployment of the UMTS network through speeding up the network rollout and expanding the coverage area.
- Hardware complement

  RAN Sharing is an effective way to overcome such problems as shortage of sites or antennas, especially in areas of poor environmental conditions.
- Better service

  RAN Sharing frees operators from heavy workload of rolling out and operating networks. Therefore, operators can focus on end user services.

RAN Sharing, however, also has some limitations. Reduced independence may lead to closer cooperation between operators and may impose some restrictions during capacity expansion.

Intended Audience

This document is intended for:

- System operators who need a general understanding of RAN sharing.
- Personnel working on Huawei products or systems.

Impact

- **Impact on System Performance**

  This feature has no impact on system performance.

- **Impact on Other Features**

  The main impact on other features is listed as follows:

  – Performance Management (PM) and Configuration Management (CM).

  – License management.

NOTE

The two frequencies in one Power Amplifier (PA) must be consecutive within 10 MHz. In actual network deployment, operators need to coordinate the frequencies with each other.

Network Element Involved

Table 2-1 shows the Network Elements (NEs) involved in RAN Sharing.

Table 2-1 NEs involved in RAN Sharing

UE	NodeB	RNC	MSC Server	MGW	SGSN	GGSN	HLR
–	√	√	–	–	–	–	–

NOTE:

- –: not involved
- √: involved

UE = User Equipment, RNC = Radio Network Controller, MSC = Mobile Service Switching Center, MGW = Media Gateway, SGSN = Serving GPRS Support Node, GGSN = Gateway GPRS Support Node, HLR = Home Location Register

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3 RAN Sharing Principles

The following lists the contents of this chapter.

- Typical Networking Modes and Scenario Analysis of RAN Sharing
- RAN Sharing Functionality
- RAN Sharing Function Switch
- RAN Sharing RNC Interfaces
- RAN Sharing Operator Identities and Types
- RAN Sharing License Management
- RAN Sharing OM
- Hardware Configurations for RAN Sharing

3.1 Typical Networking Modes and Scenario Analysis of RAN Sharing

Typical Networking Modes and Scenario Analysis of RAN Sharing includes five typical application scenarios:

- Coexistence of shared and non-shared RNCs under full coverage
- Coexistence of shared RNC and 2G network
- Coexistence of full and partial coverage for different operators
- Coexistence of Iu Flex and RAN Sharing
- Coexistence of Multiple Operators.

3.1.1 Coexistence of Shared and Non-shared RNCs Under Full Coverage

In the example shown in Figure 3-1, both operator A and operator B have deployed their own non-shared 3G networks in one area and decide to deploy a shared 3G network together in another area. Shared RNC1 is connected to shared RNC2, RNC A and RNC B over the Iur interfaces. The neighboring cell relationships are also configured. Thus, a UE of

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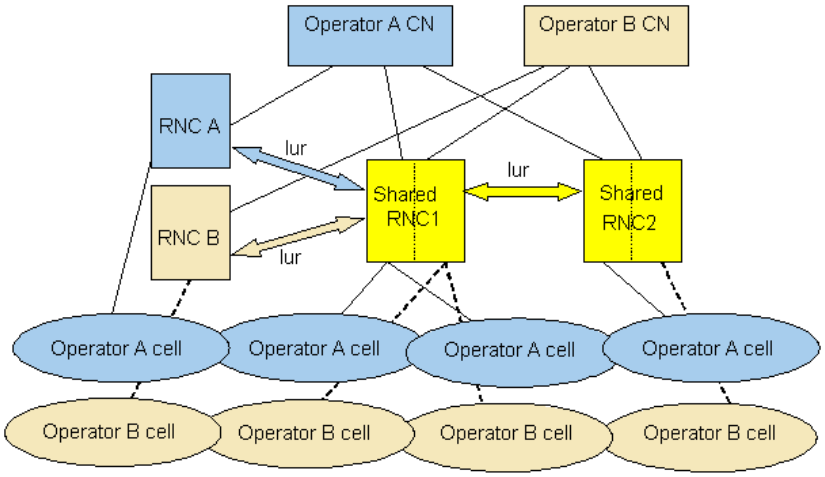
operator A is free to transfer from an operator A cell to the neighboring operator A cell by soft handover. The same situation applies to operator B. This scenario is applicable to an early stage of network rollout when there is a small number of subscribers.

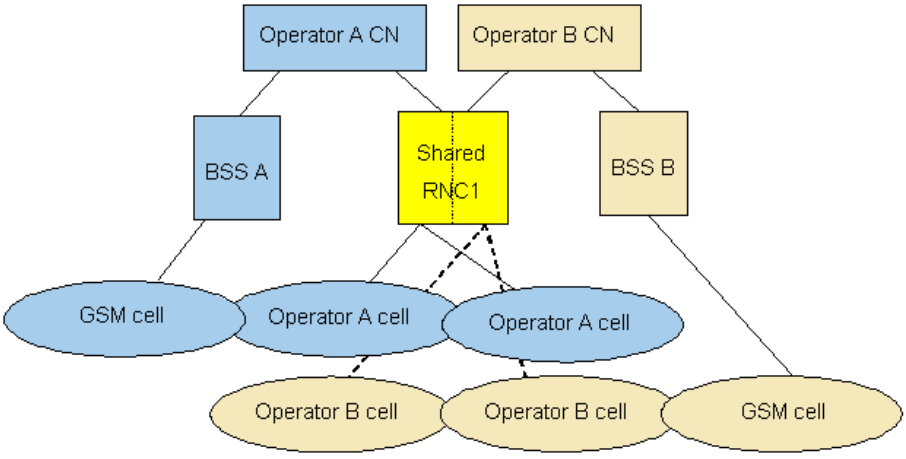
Figure 3-1 Coexistence of shared and non-shared RNCs under full coverage



3.1.2 Coexistence of Shared RNC and 2G Network

In the example shown in Figure 3-1, both operator A and operator B have deployed a GSM network and decide to deploy a shared 3G network. To fully use the GSM resources, the new RAN network is required to interwork with the existing GSM network. Therefore the neighboring cells on shared RNC1, Base Station System (BSS) A and BSS B are configured. Thus, service continuity is assured when a UE of operator A transfers between the operator A UMTS cell and the neighboring operator A GSM cell. The same situation applies to operator B.

Figure 3-1 Coexistence of shared RNC and 2G network



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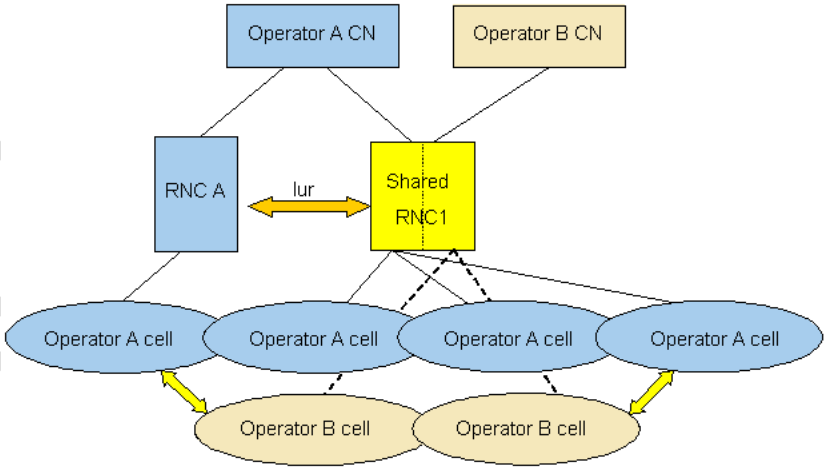
3.1.3 Coexistence of Full and Partial Coverage for Different Operators

In the example shown in Figure 3-1, operator A has already deployed a RAN network and has a full coverage, whereas operator B only has partial coverage. Operator B must share the RAN network with operator A in uncovered areas of operator B to achieve full coverage.

When a UE of operator B transfers from the edge of a cell under operator B's coverage to an area under operator A's coverage, the UE can access the cell of operator A through handover, cell reselection, or cell update. When the UE transfers back to an area covered by both operators, the UE can also re-access operator B's network through Shared Network Area (SNA) or International Mobile Subscriber Identity (IMSI)-based handover.

In this scenario, the switch of **InterPlmnHoAllowedIntraRat** must be enabled and the neighboring cell relationships must be configured.

Figure 3-1 Coexistence of full and partial coverage for different operators

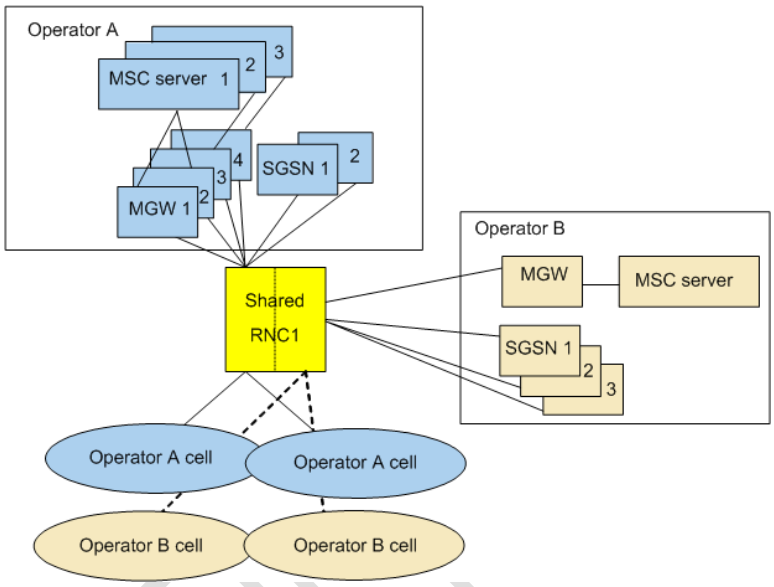


3.1.4 Coexistence of Iu Flex and RAN Sharing

In the example shown in Figure 3-1, operator A and operator B share the RAN. To improve the network reliability, operator A applies Iu Flex to both the Circuit Switched (CS) and the Packet Switched (PS) domains, and operator B applies Iu Flex to the PS domain.

In this scenario, services of one operator can only be processed by the CN nodes of this operator.

Figure 3-1 Coexistence of Iu Flex and RAN Sharing

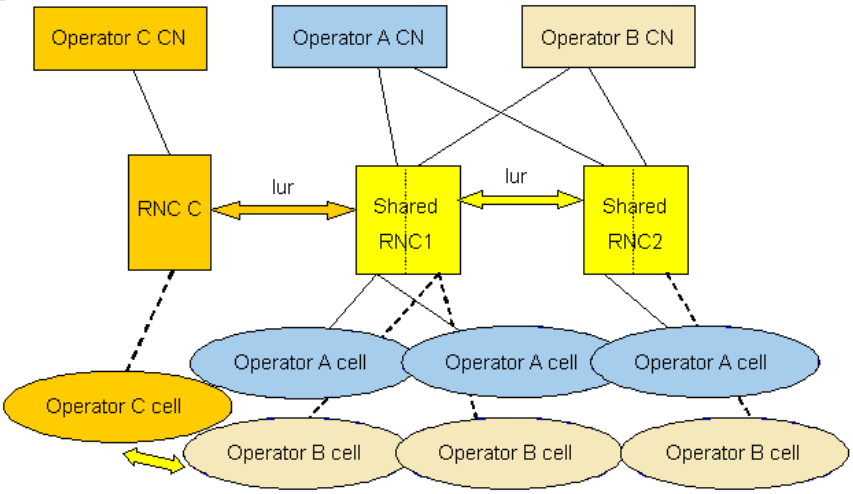


3.1.5 Coexistence of Multiple Operators

In the example shown in Figure 3-1, operator A and operator B share a RAN, and operator C has a roaming agreement with operator B. This agreement allows all the subscribers of operator B and operator C to share the network resources.

To achieve roaming (such as handover and cell reselection) between the cells of operator B and operator C, the switch of **InterPlmnHoAllowedIntraRat** must be enabled and the neighboring cell relationships must be configured.

Figure 3-1 Coexistence of multiple operators



3.2 RAN Sharing Functionality

RAN Sharing Functionality describes the impact on some basic functions of RAN Sharing.

3.2.1 System Information Broadcasting

Each cell pertains to a unique PLMN identity. The PLMN identity is broadcast in the master information block of each cell. For system information broadcasting, there is no essential difference between shared RNC and non-shared RNC except that shared RNC supports multiple PLMNs.

3.2.2 Initial NAS Message Routing

From the initial Non-Access Stratum (NAS) message, the RNC identifies the operator by the PLMN identity and the CN domain. The Iu Flex means that multiple SGSNs or MSC servers of one operator connect to an RNC.

- If Iu Flex is not used, there is only one CN node for the operator in each domain. Thus the initial NAS message is directly routed to this CN node according to the CN domain.
- If Iu Flex is used, the NAS Node Selection Function (NNSF) procedure is performed to select a specific CN node from the CN nodes of the operator.

NOTE
Whether RAN Sharing is adopted or not, a CN node such as MSC server and SGSN belongs to one operator only.

3.2.3 Operator Dedicated CBS

In RAN Sharing, each operator deploys its own CBC.

One cell corresponds to one Cell Broadcast Service (CBS) Service Area (SA) and the operator broadcasts messages in its own CBS SA.

3.2.4 Operator Dedicated Features

Operator dedicated features are achieved by setting RNC license and parameters. There is only one RNC license for a shared RNC. The license can be individually activated for operators through which the operators are entitled different capacities and functions. The parameters are defined as different levels shown as follows.

- **RNC**: RNC level parameters. An RNC has only one set of the RNC-level parameters shared by all operators.
- **Cell**: cell level parameters. Cell level parameters are different for each cell. Operators can achieve different algorithm performances in different cells.
- **Both RNC and cell**: some parameters on the RNC level and others on the cell level.
- **Operator**: operator level parameters.

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- **NodeB**: NodeB level parameters.

Table 3-1 lists the parameter levels.

Table 3-1 Parameter levels

Optional Feature	Parameter Level
PDCP Header Compression (RFC2507)	RNC
Cell ID + RTT Function Based LCS	Both RNC and cell
Inter-Frequency Load Balance	Both RNC and cell
Potential User Control	Cell
Intra-Frequency Load Balance	Cell
AMR/WB-AMR Speech Rates Control	Both RNC and cell
Intra-System Direct Retry	Both RNC and cell
Inter-System Direct Retry	Both RNC and cell
Inter-System Redirect	RNC
Cell Broadcast Service	Both RNC and cell
AGPS Based LCS	Both RNC and cell
OTDOA Based LCS	Both RNC and cell
Hierarchical Cell Structure (HCS)	Both RNC and cell
Queuing and Pre-emption	RNC
Inter-RAT Handover Based on Service	Both RNC and cell
Inter-RAT Handover Based on Load	Both RNC and cell
RAB Quality of Service Renegotiation over Iu	RNC
LCS Classified Zones	Operator
Iu Flex	Operator
Iu Flex Load Distribution Management	Operator
MBMS Function	Both RNC and cell
Adaptive Multi Rate Wide Band (AMR-WB)	Both RNC and cell
High Speed Downlink Packet Access	Both RNC and cell
High Speed Uplink Packet Access	Both RNC and cell
IP Transportation on Iub Interface	NodeB
Satellite Communication on Iub Interface	NodeB
IMS Signaling over HSPA	RNC

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Optional Feature	Parameter Level
HSDPA 13.976 Mbps per User	RNC
HS-DPCCH Preamble support	RNC
HSDPA over Iur	RNC
SRB over HSDPA	RNC
2ms/10ms TTI Handover	RNC
HSUPA 5.74 Mbps per User	RNC
HSUPA over Iur	RNC
SRB over HSUPA	RNC
MBMS P2P over HSDPA	RNC
PDCP Header Compression (RoHC)	RNC
Active Queue Management (AQM)	RNC
Inter Frequency Hard Handover Based on DL QoS	RNC
3G/2G Common Load Management	RNC
Inter-RAT Handover Based on DL QoS	RNC
Multi Frequency Band Networking Management	RNC
60 HSUPA Users per Cell	Both RNC and cell
MBMS Admission Enhancement	Both RNC and cell
MBMS 16 Channels per Cell	Both RNC and cell
MBMS Enhanced Broadcast Mode	RNC
MBMS over Iur	RNC
Separation of Transmission Resources for the Iub user plane	RNC
Traffic Priority Mapping on Transport	RNC
FP MUX	RNC
BFD/ARP IP Re-route	RNC
Overbooking on IP Transmission	RNC
Dynamic Bandwidth Control of Iub IP	RNC
CS voice over HSPA	RNC
96 HSDPA Users per Cell	Both RNC and Cell
HSPA+ Downlink 21 Mbit/s Per User	RNC

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Optional Feature	Parameter Level
HSPA+ Downlink 28 Mbit/s Per User	RNC
96 HSUPA Users per Cell	Both RNC and Cell
Enhanced CELL_FACH	Cell
CPC-HS-SCCH Less Operation	RNC
CPC-DTX/DRX	RNC
Domain Specific Access Control (DSAC)	Both RNC and Cell
Service Steering in RRC Connection Setup	RNC
MOCN Introduction Package	RNC
MSCH Scheduling	RNC

3.2.5 Mobility Control

The inter-RAT handover between different operators are supported. A switch of **InterPlmnHoAllowedInterRat** is used to control whether handover between different operators is allowed in the 3G coverage. Inter-RAT Ho Allowed InterRat is ON by default.

The intra-RAT handover between different operators are supported. A switch of **InterPlmnHoAllowedIntraRat** is used to control whether handover between different operators is allowed in the 3G coverage.

NOTE

Only when the switch of **InterPlmnHoAllowedIntraRat** is set to **YES**, the intra-frequency and inter-frequency neighboring cell relationship between different operators can be configured.

Only when the switch of **InterPlmnHoAllowedInterRat** is set to **YES**, the intra-frequency and inter-frequency neighboring cell relationship between different operators can be configured.

3.3 RAN Sharing Function Switch

RAN Sharing Function Switch describes function switches pertaining to different functions of RAN Sharing.

Besides the dedicated frequency function RAN Sharing has integrated the function of separation of transmission resources for the Iub user plane. RAN Sharing has three switches to control the two functions.

To enable RAN Sharing dedicated frequency function:

- **RANSharingSupport** is set to **YES**.
- **RANSHARE(RAN sharing)** of **FunctionSwitch2** is selected.

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- To enable RAN Sharing separation of transmission resources for the Iub user plane:
- **RANSharingSupport** is set to **YES**.
- **RANSHARE(RAN sharing)** of **FunctionSwitch2** is selected.
- **RAN_SHARING_ENHANCED_PACKAGE(RAN Sharing Enhanced Package)** of **FunctionSwitch3** (FUNCTIONSWITCH3) is selected.

3.4 RAN Sharing RNC Interfaces

All physical connections supported by the shared RNC are the same as those supported by the non-shared RNC.

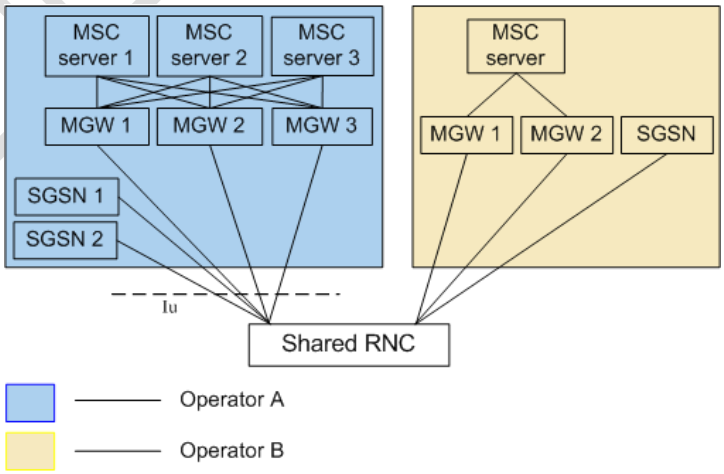
3.4.1 Iu Interface

Typically unchannelized STM-1/OC-3c optical ports on the UOIa board are used on the Iu interface. Because an operator can only use the operator's own CN nodes, each operator can use one or more optical ports to connect its own CN nodes. The physical bandwidth related to the physical ports is operator dedicated.

In the shared RNC, a global CN identity is added to each CN node. The global CN identity consists of the PLMN-ID and the CN-ID.

Figure 3-1 shows an example where the RNC is shared by operator A and operator B. Operator A uses Iu Flex, whereas operator B does not.

Figure 3-1 Operator A and operator B share an RNC with operator A using Iu Flex



The switch to enable or disable Iu Flex is configurable for each operator, that is, the operator can individually enable or disable Iu Flex. The configuration of Iu Flex in the shared RNC is similar to that in the non-shared RNC. In the shared RNC, the configuration for the initial NAS

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message routing should be performed separately by each operator. The configuration is as follows:

- NRI length for the CS or PS domain.
- Mapping between NRI and global CN identity.
- Mapping between IMSI route value and global CN identity.

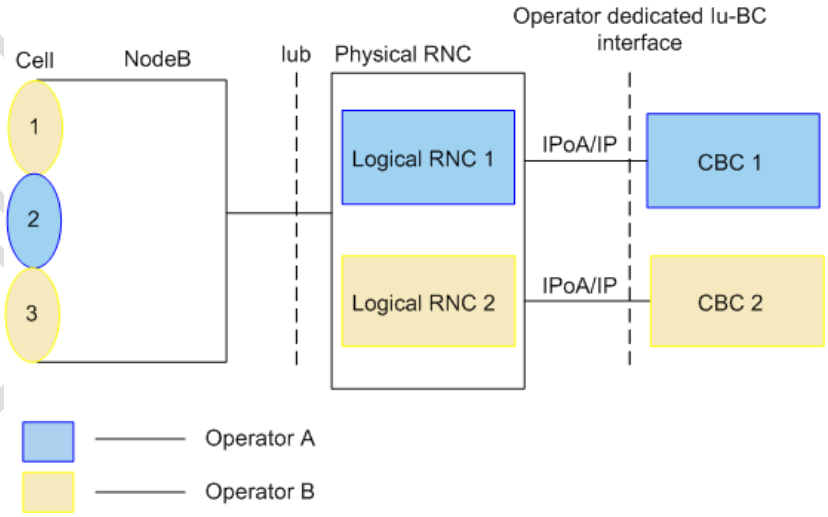
NOTE
IMSI route value =(IMSI div 10) mod 1000. The value range is 0-999.

3.4.2 Iu-BC Interface

In a non-shared RNC, only one CBC can be connected. In a shared RNC, each operator can have a dedicated CBC and a maximum of four CBCs can be connected. The Iu-BC interface is dedicated to each operator and the CBS is limited in each operator's own cells.

On the Iu-BC interface, the Service Area Broadcast Protocol (SABP) peer entity uses TCP/IP. Each operator that employs CBS should separately configure the dedicated connections to the operator's own CBC, as shown in Figure 3-1.

Figure 3-1 Operator dedicated Iu-BC connection in the shared RAN



3.4.3 Iub Interface

The shared RNC supports both shared and non-shared NodeBs. The maximum number of NodeBs and cells supported by the shared RNC is the same as that supported by the non-shared RNC.

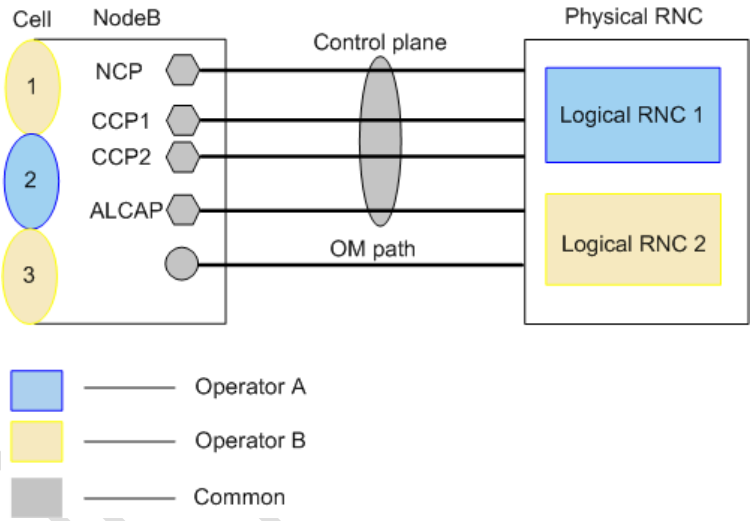
Transmission for the Iub Control Plane and Management Plane

As shown in Figure 3-1, the NCP, CCPs, ALCAP link, and OM path are common to all operators that share the NodeB. Each NodeB has one unique NCP, one unique ALCAP link and multiple CCPs. The mapping

between cells and CCPs is not fixed. A unique OM path for one NodeB is recommended though multiple OM paths are allowable.

The NCP is used for the common NBAP procedures such as cell setup, cell reconfiguration, common transport channel setup, and radio link setup. All the operators must share the NCP, such as cell setup for cell 1, cell 2, and cell 3. The CCP is selected by the load balancing policy instead of the operator involved or the cell where a call is originated.

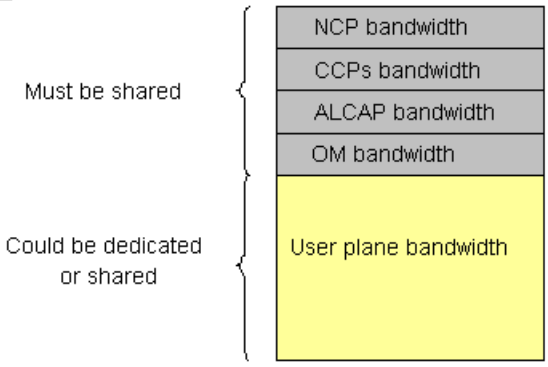
Figure 3-1 Shared Iub connections



Transmission for the Iub User Plane

The transmission resources for the Iub uer plane can be shared or dedicated by operators, see Figure 3-2.

Figure 3-2 Separation of transmission resources for the Iub user plane



The parameter **RscMngMode** is used to control whether the transmission resources for the Iub user plane is separated or not.

When separation of the transmission resources for the Iub user plane is enabled, the transmission resources of the Iub user plane can be

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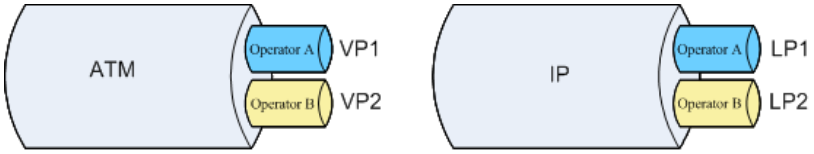
configured into different Virtual Ports (VPs) or Logical Ports (LPs) as shown in Figure 3-3. The VP is for ATM and the LP is for IP. Each VP or LP is specified for an individual operator only.

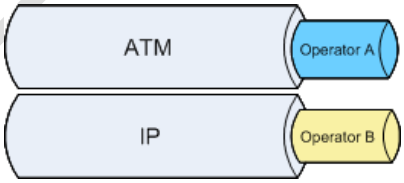
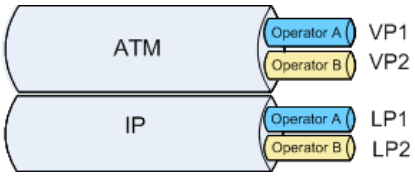
The VP and LP traffic shaping is supported. The admission control is based on a VP or an LP. RNC detects and resolves the transmission congestion through an individual operator. Otherwise, the transmission resources of the Iub user plane are totally shared by operators.

Figure 3-3 Separation by VP or LP



When ATM/IP dual stack is adopted, there are two cases as shown in Table 3-1.

Table 3-1 Cases when ATM/IP dual stack is adopted

Case	Method
Two operators engage two stacks respectively.	
Two operators engage each stack.	

3.4.4 Iur Interface

Iur transmission resource is totally shared between operators. Typically, unchannelized STM-1/OC-3c ports on the UOIa board are used on the Iur interface in ATM transport, and the physical interfaces and bandwidth are shared by operators.

As shown in Figure 3-1, the Iur control plane is shared. In ATM transport, MTP3-b links connecting the RNCs work in load sharing mode.

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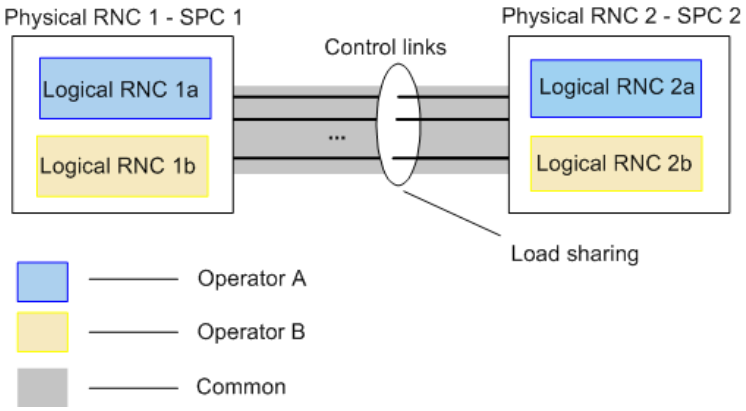
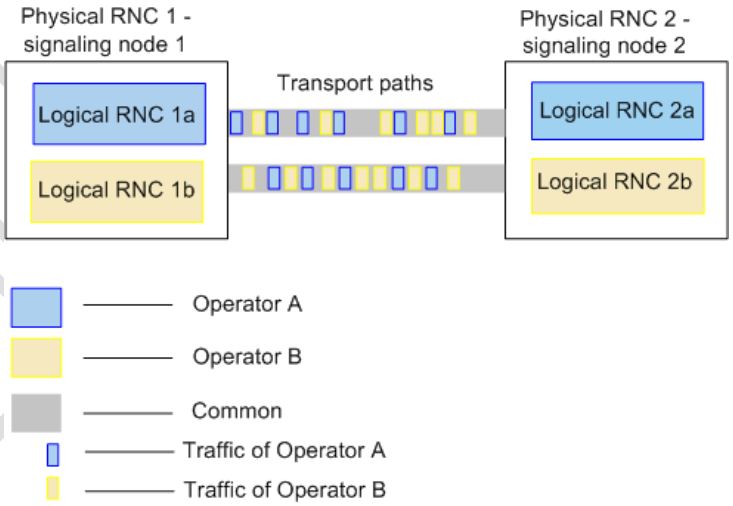
Figure 3-1 Iur control plane of two RNCs shared by operators A and B



As shown in Figure 3-2, the Iur user plane is also shared. In ATM transport, all AAL2 paths are common resources of all operators and each AAL2 path can carry the traffic of all operators.

Figure 3-2 Iur user plane of two RNCs shared by operators A and B



3.5 RAN Sharing Operator Identities and Types

RAN Sharing Operator Identities and Types describe how an operator is identified and the two types of operators after RAN Sharing is introduced.

3.5.1 Operator Identities

Both PLMN identity and **CnOpIndex** are used to identify an operator but within different scope.

- To identify an operator globally

An operator globally corresponds to a unique PLMN identity, which consists of **MCC** and **MNC**. **MCC** represents a mobile country and **MNC** usually distinguishes the operators in a mobile country.

- To identify an operator in a RAN

  A new parameter **CnOpIndex** is introduced to identify a unique operator in a RAN.

3.5.2 Operator Types

There are two types of operators, primary operator and secondary operator, in RAN sharing. A primary operator has a higher privilege in authority management and license management than a secondary operator. The primary operator can be anyone, for example, a third party in charge of the shared RAN network or an operator in possession of the physical RAN equipment.

When adding an operator to the RNC, **OperatorType** has to be used to state if the operator is a primary one or a secondary one. One primary operator must be specified in an RNC.

3.6 RAN Sharing License Management

There still exists one RNC license and one NodeB license for a shared RAN. Licenses, which define all the functions and equipment resources, can be distributed between different operators and must be activated before using the functions and resources.

The NodeB license can only be managed on the M2000, whereas the RNC license can be managed either on the M2000 or on the LMT.

3.6.1 RAN Sharing Control Items of NodeB License

The NodeB license consists of resource control items and function control items. The operators' resources and functions are defined by different groups in a NodeB license, including a private group for each operator and a common group (if any).

Groups

The private group and common group are defined as follows:

- Private group

  Each operator who shares the NodeB has a corresponding private group in the NodeB license. The private group defines the operator's dedicated resources and functions. For example, private group A defines resources and functions that can be used by operator A only.

- Common group

  The common group is optional in the NodeB license. The group defines common resources and functions that can be used by all operators.

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Some examples are given below:

- Example 1: Operators A and B use different frequencies. They share Channel Elements (CEs), which are jointly purchased by the two operators.

  In this case, the NodeB license has three groups: private group A, private group B, and common group. Private group A contains operator A's own frequency information. Similarly, private group B contains operator B's own frequency information. The common group defines the number of CEs.
- Example 2: Operators A and B use different frequencies. Each operator purchases the CEs. The total number of CEs must not exceed the supported hardware capacity.

  In this case, the NodeB license defines two groups: private group A and B. Each private group defines the operator's frequency information and number of CEs.

Resource Control Items

Resource control items include CEs, HSDPA codes, frequencies, and Power Amplifier (PA) output power.

CE Usage Principle

NOTE
The total number of CEs in a NodeB license cannot exceed the supported capacity of the NodeB hardware.

When a Radio Link (RL) is to be set up, it consumes the CEs in the private group first. If the required CEs exceed 110% of the CEs in the private group, the RL begins to consume the CEs in the common group. If the required CEs still exceed 110% of the CEs in the common group, the RL setup fails.

For example, assume that one NodeB is shared by operators A and B. Operator A has cells 0, 1, and 2. Operator B has cells 3, 4, and 5. There are three groups in the NodeB license: private group A, private group B, and common group. Each of the three groups has 8 UL CEs and 8 DL CEs. If there is a 384 kbit/s call request in cell 0, the call requires 10 UL CEs. Thus, the call uses 9 UL CEs of private group A and 1 UL CE of the common group. If, at the same time, there is another 384 kbit/s call request in cell 3 and the call also requires 10 UL CEs, the call uses 9 UL CEs of private group B and 1 UL CE of the common group. In total, 2 UL CEs of the common group are used.

Usage Principle of HSDPA Codes, Frequencies, and PA Output Power

The usage principle of HSDPA codes, frequencies, and PA output power is similar to that of the CEs. The only difference between the two principles is that the threshold is 100% rather than 110% of HSDPA codes, frequencies, and PA output power in the private group and in the common group.

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Function Control Items

Function control items include HSDPA function, HSUPA function, MBMS function, and HSDPA RRM Package1.

An operator can use the previous four functions as long as the functions are enabled either in the private group or in the common group.

3.6.2 RAN Sharing Control Items of RNC License

The RNC license consists of resource control items and function control items. The RNC license must be activated by each operator. When there are multiple operators in the RNC, the RNC license is activated in the sequence of, first by the primary operator, and then by the secondary operators. No sequence between secondary operators is required.

Resource Control Items

The resource control items in the RNC license include the Max User Number of CS and the Max throughout of PS. For all the operators, the total Max User Number of CS must be no larger than that defined in the RNC license, and the Max throughput of PS is the same.

Function Control Items

The RNC license provides more than 60 function control items which can be classified into two types: the item totally controlled by the primary operator and the item controlled by each operator.

The item totally controlled by the primary operator allows the function to be enabled or disabled by the RNC instead of an individual operator. The function can be disabled when any of the following conditions is met:

- The function control item is disabled in the RNC license.
- The function control item is deselected when **ACT LICENSE** is run for the primary operator.

The item controlled by each operator allows the function to be enabled or disabled by an individual operator. The function can be disabled by an individual operator when any of the following conditions is met:

- The function control item is disabled in the RNC license.
- The function control item is deselected when the RNC license is activated by the operator.

The items totally controlled by the primary operator are listed as follows:

- **RANSHARE(RAN sharing)**.
- **RAN_SHARING_ENHANCED_PACKAGE(RAN Sharing Enhanced Package)**.
- **ATMIPDUALSTACK(IUB ATM/IP Dual Stack Transportation Function)**.
- **IPTRANINIUR(IP Transportation in Iur Interface)**.

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- **FRACTIONALIP(Fractional IP)**.
- **FRACTIONALATM(Fractional ATM)**.
- **IPIUBOVERBOOKING(IP IUB overbooking Function)**.
- **ATMOVERBOOKING(ATM IUB overbooking Function)**.
- **IUBHYBRIDIPTRAN(IUB Hybrid IP Transportation Function)**.
- **ACRWHENSPUOVER(Access Class Restriction when SPU overload)**.

Other function control items in the RNC license are those controlled by each operator.

3.7 RAN Sharing OM

Most OM flows in a shared network are the same as those in a non-shared network. RAN Sharing OM describes the OM architecture of RAN Sharing and how data are managed through the Itf-N and the proprietary CM interface.

3.7.1 RAN Sharing OM Architecture

When RAN Sharing is applied, OM architecture consists of shared master Operation Support System (OSS), operator Network Management System (NMS) and interfaces.

Figure 3-1 shows a typical OM architecture of RAN Sharing, which is composed of Operator A NMS, Operator B NMS, shared master OSS and interfaces. Each part consists of:

- Shared master OSS

  Local Maintenance Terminal (LMT), Configuration Management Express (CME) and M2000.
- Operator NMS

  managers.
- Interfaces

  Itf-N FM&PM&CM,

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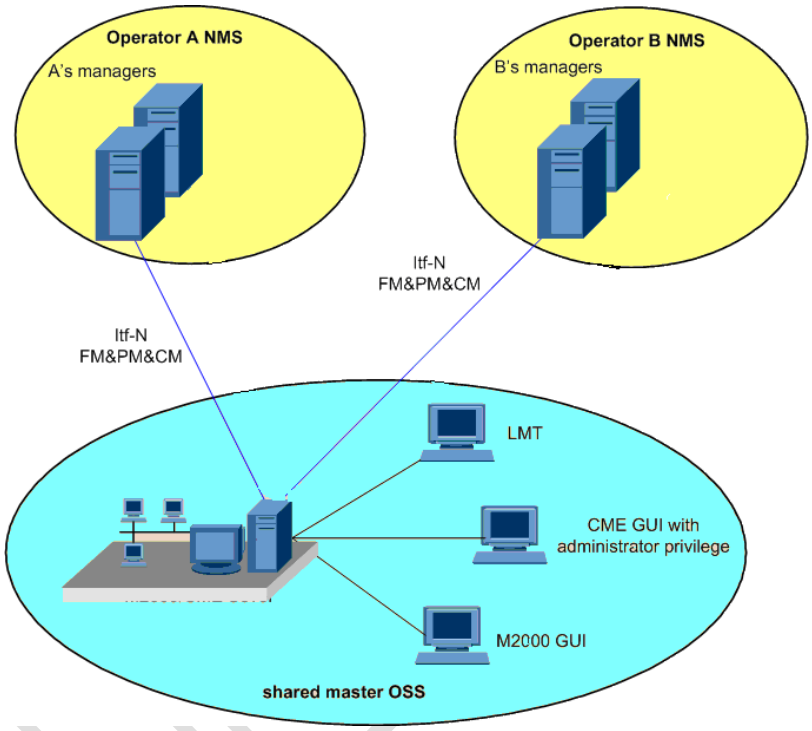
Figure 3-1 OM architecture of RAN Sharing

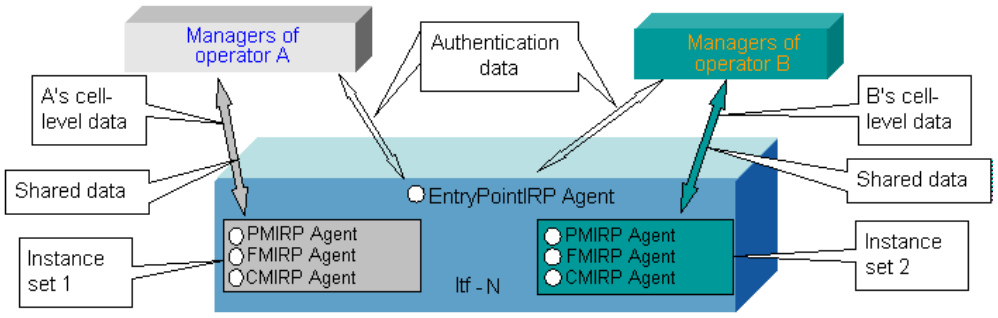


The shared master OSS is in charge of network management and OM functions. One of the operators or a third party is expected to operate the shared master OSS, which is up to the commercial agreement among operators. The shared master OSS provides the northbound interface for each operator's NMS and independent access to cell-level Fault Management (FM), PM and CM for each operator. RAN Sharing Itf-N FM&PM&CM

RAN Sharing enables different operators to access and perform operations on their dedicated or shared data through Itf-N.

Itf-N refers to the northbound interface. The FM part of Itf-N is Common Object Request Broker Architecture (CORBA) interface. The PM and CM part of Ift-N is file interface. Itf-N is redesigned for RAN Sharing, as shown in Figure 3-2.

Figure 3-2 Redesigned Itf-N



Instance Set

Each operator has multiple managers, and all the managers of the different operators are connected to the M2000 on Itf-N.

On Itf-N, all the managers of one operator have the same identity and the M2000 recognizes which operator the manager belongs to through the identity. The M2000 generates a specific type of IRP Agent instance for each manager, for example PMIRP Agent for a PM manager. All IRP instances with the same identity form an instance set. As shown in I. Figure 3-2, PMIRP, FMIRP and CMIRP Agent instances of operator A constitute Instance set 1.

Authentication

The M2000 creates an account to authorize managers to connect with the shared master OSS through Itf-N. The account can be added, modified, deleted, or queried on the M2000. For detailed information, see the *M2000 Online Help*.

When creating the account, an FTP account is automatically generated in order to transfer files on Itf-N PM&CM.

FM&PM&CM Data Type

When RAN Sharing is applied, the FM&PM&CM data on Itf-N is classified into two types:

- Operator dedicated data

  Operator dedicated data refers to cell-level FM&PM&CM data. It is only related to a specific operator and is distributed to the operator's NMS on Itf-N.
- Operator shared data

  Operator shared data refers to the other FM&PM&CM data. It is related to all operators.

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FM&PM&CM Data Collection and Operation

The operator dedicated data is collected by the corresponding instance set only. Since each instance set corresponds to one specific manager by IRP Agent, the operator dedicated data are only accessible for that manager. The operator shared data is collected by all instance sets by default, but can be configured through modification of file settings on the M2000. With this strategy, operators can access individual FM&PM&CM data and shared FM&PM&CM data through Itf-N.

The manager operates the corresponding operator dedicated data. The manager can also operate the operator shared data, depending upon the file settings on the M2000.

PM&CM File Transfer

The M2000 generates files for each operator in a home directory which is accessed by the FTP account mentioned in Authentication. The file contains the operator dedicated data. It may also contain the operator shared data, depending upon the file settings on the M2000. The file gives details about the measurement result for PM and configuration for CM respectively.

3.8 Hardware Configurations for RAN Sharing

The BTS3812E, BTS3812AE and DBS3800 in NodeB V10 version, the BTS3900, BTS3900A and DBS3900 in NodeB V210 version have typical configurations in RAN Sharing solution.

3.8.1 BTS3812E/BTS3812AE Configurations for RAN Sharing

For a BTS3812E and a BTS3812AE, the 3 x 2 and 3 x 4 NodeB configurations are available for RAN Sharing. The maximum configuration is 3 x 4 for a single cabinet.

Table 3-1 describes the BTS3812E/BTS3812AE configurations.

Table 3-1 BTS3812E/BTS3812AE configurations

Configuration		RF Subrack	Baseband Subrack	Capacity	Remarks
3 x 2	Minimum configuration	MTRU: 3 MAFU: 3	HBBI: 2 HULP: 0 HDLP: 0 NMPT: 1 NUTI: 1	• UL: 256 CE • DL: 512 CE	A pair of frequencies in the same sector must be two consecutive frequencies within 10 MHz.
	Maximum	MTRU: 6	HBBI: 2	• UL: 768 CE	–

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Configuration		RF Subrack	Baseband Subrack	Capacity	Remarks
	configuration	MAFU: 6	HULP: 4 HDLP: 1 NMPT: 1 NUTI: 1 to 3	• DL: 1024 CE	
3 x 4	Minimum configuration	MTRU: 6 MAFU: 6	HBBI: 2 HULP: 2 HDLP: 1 NMPT: 1 NUTI: 1 to 3	• UL: 512 CE • DL: 1024 CE	One sector uses two PAs. A pair of frequencies in the same PA must be two consecutive frequencies within 10 MHz. The frequencies in different PAs can be inconsecutive.
	Maximum configuration	MTRU: 6 MAFU: 6	HBBI: 2 HULP: 6 HDLP: 2 NMPT: 1 NUTI: 1 to 3	• UL: 1024 CE • DL: 1536 CE	

NOTE:
- The 3 x 4 configuration is available for macro NodeBs from RAN 6.0.
- Baseband capacity increases with the baseband board expansion. The total number of CE licenses cannot exceed the baseband capacity.

Table 3-2 describes the configurations in a single cabinet available for operator A and operator B in RAN Sharing solution. The number of baseband boards is configured to meet the requirements of operators that share the RAN.

Table 3-2 Single cabinet configurations available for operator A and operator B

Configuration		Operator A	Operator B	Remarks
3 x 2	MTRU: 3 MAFU: 3	3 x 1	3 x 1	A pair of frequencies in the same sector must be two consecutive frequencies within 10 MHz.
	MTRU: 6 MAFU: 6	3 x 1	3 x 1	–
3 x 4	MTRU: 6	3 x 1	3 x 3	One sector uses two PAs. A pair of frequencies in the same PA must be two consecutive frequencies within 10 MHz.
		3 x 2	3 x 2	

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Configuration		Operator A	Operator B	Remarks
	MAFU: 6	3 x 3	3 x 1	The frequencies in different PAs can be inconsecutive.

3.8.2 DBS3800 Configurations for RAN Sharing

For a DBS3800, the 3 x 2 and 3 x 4 NodeB configurations are available for RAN Sharing. The maximum configuration is 3 x 4 for a single cabinet.

Table 3-1 describes the DBS3800 configurations.

Table 3-1 DBS3800 configurations

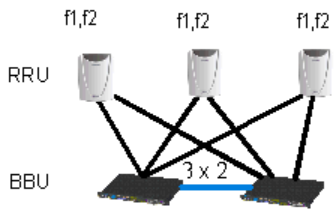
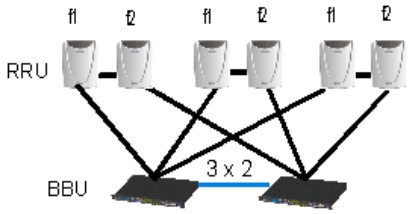
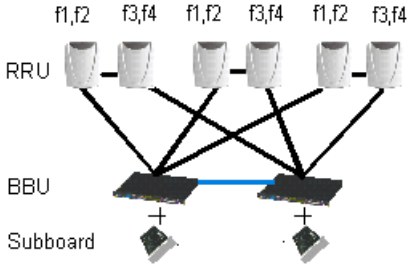
Configuration	Modules	Diagram	Capacity	Remarks
3 x 2	RRU: 3 BBU: 2		• UL: 384 CE • DL: 512 CE	The pair f1, f2 must be two consecutive frequencies within 10 MHz.
	RRU: 6 BBU: 2			–
3 x 4	RRU: 6 BBU: 2		• UL:768 CE • DL:1024 CE	The pair f1, f2 must be two consecutive frequencies within 10 MHz. The pair f3, f4 must be two consecutive frequencies within 10 MHz. There is no limit to the continuity of the pair f1, f2 and the pair f3, f4.

Table 3-2 describes the configurations available for operator A and operator B when RAN Sharing is applied.

Table 3-2 Single cabinet configurations available for operator A and operator B

Configuration		Operator A	Operator B	Remarks
3 x 2	RRU: 3 BBU: 2	3 x 1	3 x 1	The pair f1, f2 must be two consecutive frequencies within 10 MHz.
	RRU: 6 BBU: 2	3 x 1	3 x 1	–
3 x 4	RRU: 6 BBU: 2	3 x 1	3 x 3	The pair f1, f2 must be two consecutive frequencies within 10 MHz. The pair f3, f4 must be two consecutive frequencies within 10 MHz. There is no limit to the continuity of the pair f1, f2 and the pair f3, f4.
		3 x 2	3 x 2	
		3 x 3	3 x 1	

3.8.3 BTS3900/BTS3900A Configurations for RAN Sharing

For a BTS3900 and a BTS3900A, the 3 x 2 and 3 x 4 NodeB configurations are available for RAN Sharing. The maximum configuration is 3 x 4 for a single cabinet.

Table 3-1 describes the BTS3900/BTS3900A configurations.

Table 3-1 BTS3900/BTS3900A configurations

Configuration		RF Subrack	Baseband Subrack	Capacity	Remarks
3 x 2	Minimum configuration	WRFU-40W2C: 3	WBBPa: 2 WMPT: 1	• UL: 256 CE • DL: 512 CE	-
	Maximum configuration	WRFU-80W4C: 6	WBBPa: 4 WMPT: 1 UTRP: 1 to 3	• UL: 512 CE • DL: 1024 CE	-
3 x	Minimum	WRFU-80W4C: 3	WBBPa: 4	• UL: 512	-

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Configuration		RF Subrack	Baseband Subrack	Capacity	Remarks
4	configuration		WMPT: 1 UTRP: 1 to 3	CE • DL: 1024 CE	
	Maximum configuration	WRFU-80W4C: 6	WBBPa: 4 WMPT: 1 UTRP: 1	• UL: 512 CE • DL: 1024 CE	-
NOTE: • Baseband capacity increases with the baseband board expansion. The total number of CE licenses cannot exceed the baseband capacity.					

Table 3-2 describes the configurations in a single cabinet available for operator A and operator B in RAN Sharing solution. The number of baseband boards is configured to meet the requirements of operators that share the RAN.

Table 3-2 Single cabinet configurations available for operator A and operator B

Configuration		Operator A	Operator B	Remarks
3 x 2	WRFU-40W2C: 3	3 x 1	3 x 1	-
	WRFU-80W4C: 6	3 x 1	3 x 1	-
3 x 4	WRFU-80W4C: 3	3 x 1	3 x 3	-
		3 x 2	3 x 2	
		3 x 3	3 x 1	
	WRFU-80W4C: 6	3 x 1	3 x 3	-
		3 x 2	3 x 2	
		3 x 3	3 x 1	

3.8.4 DBS3900 Configurations for RAN Sharing

For a DBS3900, the 3 x 2 and 3 x 4 NodeB configurations are available for RAN Sharing. The maximum configuration is 3 x 4 for a single cabinet.

Table 3-1 describes the DBS3900 configurations.

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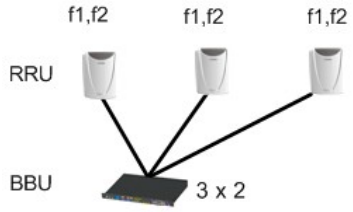
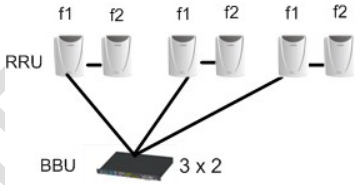
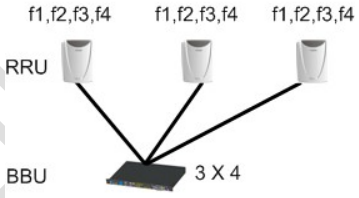
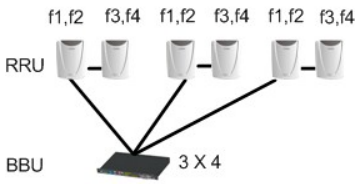
Table 3-1 DBS3900 configurations

Configuration		RF Subrack	Diagram	Baseband Subrack	Capacity	Remarks
3 x 2	Minimum configuration	RRU3804: 3		WBBPa: 2 WMPT: 1	• UL: 256 CE • DL: 512 CE	-
	Maximum configuration	RRU3804: 6		WBBPa: 4 WMPT: 1 UTRP: 1 to 3	• UL: 512 CE • DL: 1024 CE	-
3 x 4	Minimum configuration	RRU3804: 3		WBBPa: 4 WMPT: 1 UTRP: 1 to 3	• UL: 512 CE • DL: 1024 CE	-
	Maximum configuration	RRU3804: 6		WBBPa: 4 WMPT: 1 UTRP: 1	• UL: 512 CE • DL: 1024 CE	-

NOTE:

- Baseband capacity increases with the baseband board expansion. The total number of CE licenses cannot exceed the baseband capacity.
- The BBU and the RRU support ring topology. When a link is faulty, the service on the link is automatically switched over to another link.

Table 3-2 describes the configurations in a single cabinet available for operator A and operator B in RAN Sharing solution. The number of baseband boards is configured to meet the requirements of operators that share the RAN.

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Table 3-2 Single cabinet configurations available for operator A and operator B

Configuration		Operator A	Operator B	Remarks
3 x 2	RRU3804: 3	3 x 1	3 x 1	-
	RRU3804: 6	3 x 1	3 x 1	-
3 x 4	RRU3804: 3	3 x 1	3 x 3	-
		3 x 2	3 x 2	
		3 x 3	3 x 1	
	RRU3804: 6	3 x 1	3 x 3	-
		3 x 2	3 x 2	
		3 x 3	3 x 1	

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4 RAN Sharing Parameters

4.1 Description

Table 4-1 RAN sharing parameter description

Parameter ID	Description
CnOpIndex	Indicating a Cn Operator.
FUNCTIONSWITCH2	Function switch 2.
FUNCTIONSWITCH3	Function switch 3.
InterPlmnHoAllowedInterRat	This parameter specifies whether inter-RAT handover of the UE among different operators is allowed.
InterPlmnHoAllowedIntraRat	This parameter specifies whether intra-RAT handover of the UE among different operators is allowed.
MCC	Mobile country code of the RNC.
MNC	Mobile network code of the RNC.
OperatorType	Identity Operator Type,as follows: Primary Operator: Control whether the RAN support some funtion feature and distribute seconder operator's license. Second Operator: the RAN that is controled by primary operator support some funtion feature and license. Outer Operator: Operator which don't include the Primary, Second operator of the source rnc handover the target RNC to support the mobiling. Common Operator: Common Operator indicate PLMN ID the subscribe select as the same as the tradition network do in the sharing network. It is also the Serving operator
RANSharingSupport	When RAN Sharing Supported, RNC can configure multi-plmn
RscMngMode	Indicating the resource management mode.

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4.2 Values and Ranges

Table 4-1 RAN sharing parameter values and parameter ranges

Parameter ID	Default Value	GUI Value Range	Actual Value Range	Unit	MML Command	NE
CnOpIndex	-	0~3,5~31	0~3, 5~31	None	ADD NRNCURA(Mandatory)	RNC
FUNCTIONSWITCH2	-	WBAMR, HSUPA, RANSHARE, HSDPA3.6M, HSDPA7.2M, ROHC, IURLC, NACC, PSHBUG, IMSIBH, 32HSDPAUPERCELL, 64HSDPAUPERCELL, STMTRAONHSDPA, HSDPASTATETRAN, HSDPADRD, ENHANCEDIUFLEX, STMTRAONHSUPA, ATMIPDUALSTACK, IPTRANINIUR, IPTRANINIU, FRACTIONALIP, IPIUBOVERBOOKING, FRACTIONALATM, ATMOVERBOOKING, IUBHYBRIDIPTRAN, MBMS8CHANNELPERCELL, 256KBPSCHNLRATEONMBMS, MBMSFLCFLD, VTFTSFIHO, CBIHBUMTSANDG	WBAMR, HSUPA, RANSHARE, HSDPA3.6M, HSDPA7.2M, ROHC, IURLC, NACC, PSHBUG, IMSIBH, 32HSDPAUPERCELL, 64HSDPAUPERCELL, STMTRAONHSDPA, HSDPASTATETRAN, HSDPADRD, ENHANCEDIUFLEX, STMTRAONHSUPA, ATMIPDUALSTACK, IPTRANINIUR, IPTRANINIU, FRACTIONALIP, IPIUBOVERBOOKING, FRACTIONALATM, ATMOVERBOOKING, IUBHYBRIDIPTRAN, MBMS8CHANNELPERCELL, 256KBPSCHNLRATEONMBMS,	None	ACT LICENSE(Optional)	RNC

Parameter ID	Default Value	GUI Value Range	Actual Value Range	Unit	MML Command	NE
		SMGPRS, SRNSRELOCATION, SRNSRWHHANDOVER	MBMSFLCFLD, VTFTSFIHO, CBIHBUMTSANDGSMGPRS, SRNSRELOCATION, SRNSRWHHANDOVER			
FUNCTIONSWITCH 3	-	SRNSRWCUPDATE, LOSSLESSSRNSRELCT, INTERFREQHARDHNDV, IMPRVEDWNLNKCVRGE, ACRWHENSPUOVER, CBWHENIUIFAULT, 3G2GCOMMON_LOAD, FP_MUX, HSDPA_OVER_IUR, HS_DPCCH_PREAMBLE_SUPPORT, HSUPA_5_74MBPS, HSUPA_OVER_IUR, HUB_IUB_OVERBOOKING, IMS_SIGNALING_OVER_HSPA, DYN_BANDWIDTH_CTROL_IUB_IP, MBMS_OVER_IUR, MBMS_PTP_OVER_HSDPA, MBMS_ENHANCED_BROADCAST, MBMS_ADMISSION_ENHANCE, RAN_SHARING_ENHANCED_PACKAGE, SRB_OVER_HSDPA,	SRNSRWCUPDATE, LOSSLESSSRNSRELCT, INTERFREQHARDHNDV, IMPRVEDWNLNKCVRGE, ACRWHENSPUOVER, CBWHENIUIFAULT, 3G2GCOMMON_LOAD, FP_MUX, HSDPA_OVER_IUR, HS_DPCCH_PREAMBLE_SUPPORT, HSUPA_5_74MBPS, HSUPA_OVER_IUR, HUB_IUB_OVERBOOKING, IMS_SIGNALING_OVER_HSPA, DYN_BANDWIDTH_CTROL_IUB_IP, MBMS_OVER_IUR, MBMS_P2P_OVER_HSDPA, MBMS_ENHANCED_BROADCAST, MBMS_ADMISSION_ENHANCE, RAN_SHARING_	None	ACT LICENSE(Optional)	RNC

Parameter ID	Default Value	GUI Value Range	Actual Value Range	Unit	MML Command	NE
		SRB_OVER_HSUPA, MULTI_FBNM, HSDPA_13_976MBPS, BFD_ARP_IP_REROUTE, INTER_FHHBDLQOS, INTER_RHBDLQOS, MBMS_16_CHANNELS_PER_CELL, 60_HSUPA_USERS_PER_CELL, TPMT, AQM	ENHANCED_PACKAGE, SRB_OVER_HSDPA, SRB_OVER_HSUPA, MULTI_FBNM, HSDPA_13_976MBPS, BFD_ARP_IP_REROUTE, INTER_FHHBDLQOS, INTER_RHBDLQOS, MBMS_16_CHANNELS_PER_CELL, 60_HSUPA_USERS_PER_CELL, TPMT, AQM			
InterPlmnHoAllowedInterRat	-	NO, YES	NO, YES	None	SET OPERATORSHARINGMODE(Optional)	RNC
InterPlmnHoAllowedIntraRat	-	NO, YES	NO, YES	None	SET OPERATORSHARINGMODE(Optional)	RNC
MCC	-	-	000~999	None	ADD CNOPERATOR(Mandatory) ADD LASNAMAP(Mandatory) ADD IMSISNAMAP(Mandatory) ADD GSMCELL(Mandatory)	RNC
MNC	-	-	00~99, 000~999	Non	ADD	RNC

Parameter ID	Default Value	GUI Value Range	Actual Value Range	Unit	MML Command	NE
				e	CNOPERATOR(Mandatory) ADD GSMCELL(Mandatory) ADD LASNAMAP(Mandatory) ADD IMSISNAMAP(Mandatory)	
OperatorType	-	PRIM(Primary Operator), SEC(Secondary Operator), OUTER(Outer Operator), COMM(Common Operator)	PRIM, SEC, OUTER, COMM	None	ADD CNOPERATOR(Mandatory)	RNC
RANSharingSupport	-	NO, YES	NO, YES	None	SET OPERATORSHARINGMODE(Optional)	RNC
RscMngMode	SHARE	SHARE(Share), EXCLUSIVE(Exclusive)	SHARE, EXCLUSIVE	None	ADD NODEB(Optional)	RNC

NOTE

The **Default Value** column is valid for only the optional parameters.

The "-" symbol indicates no default value.

5 Reference Documents

The following lists the reference documents related to the feature:

1. 3GPP TS 23.251: Network Sharing Architecture and Functional Description
2. 3GPP TR 23.851: Network Sharing Architecture and Functional Description
3. 3GPP TS 23.236: Intra-domain Connection of RAN Nodes to Multiple CN Nodes
4. 3GPP TR 22.951: Service Aspects and Requirements for Network Sharing
5. Basic Feature Description of Huawei UMTS RAN11.0 V1.5
6. Optional Feature Description of Huawei UMTS RAN11.0 V1.5

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